Newton Was A Triathlete

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Physics. For many people, just the mention of the word gives them high school flashbacks â€“ or nightmares. Love it or hate it, physics provides us with the foundations for our understanding of the world â€“ even the world of the endurance athlete.

Let's take a common discussion topic. Athlete A, a relative newcomer to the sport, has done a few sprint triathlons and now wants to do an Olympic distance event. Athlete B, a seasoned triathlete, is finally ready to go after that first Ironman. How do either of these athletes â€œmove upâ€• and â€œgo longerâ€• successfully?

Before we get our emotions involved, get our mitochondria in a knot, and start the heated debate about lactate threshold, heart rate monitors, and the need for aerobic training, let's look to physics for a guiding light. If it is good enough to define nature, it's probably good enough for your neighborhood triathlete. Maybe, with any luck, Newton was a triathlete ...

I can hear it now ... â€œBut please, coach, don't take me back to high school physics!!! It would be a fate worse than mile repeats ...â€•

Let's simplify some key definitions. Endurance is defined as â€œthe act, quality, or power of withstanding hardship or stressâ€•. Endurance, as we know it, is the capacity to withstand physiological or psychological stressors â€“ typically over a period of time.

Newton gave us some basic laws that have provided the foundation for understanding dynamic activities, be that walking across the street, lifting a weight, or completing a triathlon. Simply put, if we look at these activities as â€œworkâ€• in physics terms, they then involve the application of various forces over a distance. As a triathlete, we have many instances of this â€“ for example, cycling, in which you are applying varying forces to the pedals - over the distance of your ride. Not that Newton needed to tell me that work was being done riding up 620 from Mansfield Dam, but I digress :-)

Mechanical systems, such as an engine, are not limited by the amount of work they can do, but rather by the rate at which they can perform the work. Power is the capacity to perform work, or the rate at which work is done (P=w/t). If we continue to use those high school math rules (or your derivations from algebra â€“ eek!) we also find that power = Force x Velocity. This would equate to a unit of measure called the watt â€“ the measure of which Lance Armstrong produces plenty!!

â€œPower trainingâ€• is a term that is oft-used, yet it's true meaning (and impact on training) is poorly understood or utilized. The most common example is on the bike - it in the context of being able to generate more power â€“ to generate more watts â€“ which leads to an improved performance. But what does this really mean?

Step back a moment and consider the following. I can increase my power (and thus my capacity to perform work over time â€“ the goal of all triathletes) by simply increasing the force I produce or the velocity at which I produce it. Isn't endurance training all about the capacity to do more work over time? Or the same work over a longer time? This leaves us with some simple observations and questions. If power is simply a product of force and velocity -

How do I increase force? The primary means is by recruiting more muscle fibers. How is this accomplished? Via increasing the resistance, load or intensity of the activity.

How do I increase velocity? The primary means is by training at a pace that is, in effect, faster than that at which you race â€“ or simply increasing the intensity/velocity of training.

If the basic mechanisms of endurance training are rooted in force and velocity, then what is the primary limiter of performance? For years, people have said that endurance is limited by the aerobic system â€“ but I would propose that it is in effect primarily limited by the neuromuscular system. Things that make you say â€œhmmmmmmmâ€• ....

And herein lies the challenge â€“ and the inherently troubling aspect for many.

For many, â€œgoing longerâ€• is a perceived mental and physical challenge, perhaps more about â€œsimply getting used to going longerâ€• than about the physiology or physics involved. But as I've noted, the basic mechanisms of increasing endurance all relate to mechanisms that are intimately related to power, velocity, and force.

Intensity, my dear endurance athlete, is your friend. The training process as we know it is simply to build power â€“ be it more work done in a shorter time, or the same workload done over a longer time. I would suggest that physics allow us to develop a better understanding of endurance training, so that we can get down to â€œbrass tacksâ€• - the base elements that allow us to optimize our training.

I can only imagine â€“ that if Newton was a triathlete, he most certainly won his age group :-)

References: Wahl, Michael. SparkNote on Review of Work, Energy and Power. 10 Jun. 2006
http://www.sparknotes.com/physics/workenergypower/review
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